Meeting Summary
CHP Summit: *A National Dialogue on Combined Heat and Power*
Washington, D.C.
December 1, 1998

Welcome and Introduction to the CHP Summit

Summit objectives and desired outcomes were provided by Dan Reicher, Assistant Secretary of the Office of Energy Efficiency and Renewable Energy, at the U.S. Department of Energy. Key points made included:

- Driving forces for CHP include economic competitiveness, electricity restructuring, environmental quality, energy security, and climate change
- CHP forges a link between district energy, distributed power, and advanced energy technologies.
- There is a need for coordinated action to make CHP a marketable component of the nation s energy portfolio; links need to be made between technologies, markets, and policies to enhance CHP.
- DOE's CHP Challenge is to double the amount of power generated with CHP by removing barriers to implementation, accelerating the installation of innovative CHP projects, and promoting partnerships.
- To reach this goal, DOE is announcing a "10-Point Action Plan":
  - identify barriers to CHP development
  - develop new policy and market mechanisms
  - expand CHP markets
  - promote advanced technologies, leverage technology R&D
  - target CHP in schools and universities
  - establish and maintain effective partnerships
  - strengthen government coordination
  - conduct outreach and education
  - showcase prominent developments
  - hold federal and state quarterly progress meetings

The Outlook for CHP from the Environmental Protection Agency

David Doniger, of the U.S. Environmental Protection Agency, spoke on *CHP's Role in U.S. Climate Policy: Achieving Least-Cost Co2 Reductions*. Key points made included:

- CHP is an energy strategy that improves the efficiency of fossil-fueled electricity power generation and reduces CO2, Nox, SO2, PM, and mercury
- CHP can benefit the environment today; it is proven, available, flexible, and cost-effective
- By 2010, CHP can provide 35 GW of electric capacity and 250 BkWh of electric

generation
- The Buenos Aires conference adopted an action plan for addressing the Kyoto Protocol, monitoring and reporting, and compliance issues
- CHP can have a role in achieving least-cost CO2 reductions while at the same time avoiding the purchase of $700 million energy supplies
- CHP should have be a source of early reductions in the U.S.
- CHP benefits the U.S. economy through development of export markets
- To realize these potentials, regulatory and financial barriers need to be identified and removed, and industry consultation should be encouraged.
- Environmental barriers to be removed include the triggering of NSR/PSD review, the duration and uncertainty of the permitting process; and the cost of add-on controls.

The Congressional Perspective - Where The Challenges Are

A panel of Congressional staff members presented their views of the challenges which stand in the way of CHP. Included on the panel were Catherine Van Way, Counsel of the House Committee on Commerce, Subcommittee on Energy and Power; Richard Russell, Staff Director of the House Committee on Science, Subcommittee on Technology, and Loretta Beaumont, Staff Assistant of the House Committee on Appropriations, Subcommittee on Interior and Related Agencies.

Ms. Van Way made the following points:

- There is a need to get the market incentives right, to get the right policies which encourage CHP
- Restructuring will spur innovation, drive down costs and improve services
- Although the current electricity generation and T&D system offers no incentive for efficiency, restructuring will provide market signals for efficiency and will allow people to choose based on their values (i.e., price, green power, etc.)
- The CHP industry must make its voice heard in Congress, so that the playing field may be leveled for CHP. Congress needs to provide:

    1. Open access
    2. Ability to get to customers/suppliers
    3. Reduced barriers to entry (i.e., unreasonable exit fees)
    4. Distribution unbundling to make electricity, as a commodity, more competitive
    5. Improved environmental permitting procedures

Mr. Russell made the following additional points:

- It will be important to provide the right incentives for improved technology policy and

R&D. Performance based standards will hopefully provide an incentive to encourage new technologies.

- Government needs to use such standards in much the same way as industries has.

Ms. Beaumont provided comments which focused on the manner in which Congress needs to hear from CHP professionals so that appropriate action may take place. Specifically, she noted that:

- Congress needs to focus its attention on where the market for CHP is, and on the technologies that need to be deployed to move the market forward. Thus, the CHP industry needs to focus its attention on specific technologies and policies which will similarly move the market forward.

- The amount of R&D dollars needed must be communicated clearly to Congress. Rather than study CHP, if it is such a good idea, projects need to be designed and completed; if the technology works, then funding for R&D stops.

- Determining the appropriate level and scope of Congressional involvement is key to success. CHP projects can be shown to work within the existing energy supply and demand system; they need to be shown in this light, and identify legislative "fixes" where necessary.

- Furthering CHP in the marketplace appears to be partly a public relations issue. The technology is understandable but potential users need to be assisted in determining its usefulness in their working environment.

Industry Response

Peter Carroll, president of the U.S. Combined Heat and Power Association (U.S. CHPA) then provided an industrial perspective on the barriers and opportunities to more global use of combined heat and power. CHP projects which did not proceed or were canceled caused a loss of generating capacity, a negative impact on carbon and Nox emission reductions, and an overall loss in market opportunity. Impediments to CHP include:

- regulatory decisions which favor traditional energy generation;
- fees/charges which make CHP non-economical;
- resistant utility policies for interconnection;
- lack of EPA support (no performance based standards in place); and
- tax policies which inhibit private investment in CHP.

Mr. Carroll provided a number of suggested actions that might be taken to remove these barriers, including:

- development of an energy efficiency vision or "roadmap" for CHP, reflecting environmental demands of restructuring, energy technologies, and political opportunities
- improvements to the institutional, technical, and management infrastructure (e.g., transmission and distribution networks, interconnection grids, etc.) to allow CHP technologies to gain support

The Market for CHP

This panel featured three speakers, David Johnson of UCLA, Chris Flavin of Worldwatch Institute, and Al Forte of American Home Products, with an introductory presentation by Paul Cicio of Dow Chemical.

As a long time champion of combined heat and power, Dow Chemical has established an energy target of 2% efficiency improvement per year. One way to do this is to use CHP at its chemical manufacturing plants world-wide. Building on the success of PURPA, industries in the U.S. will improve their competitiveness and head off utility price hikes through on-site generation of energy. More is needed to move beyond PURPA, to reduce electricity costs and meet climate change requirements. Dow Chemical supports utility restructuring, opening up financial markets to finance CHP systems, removing permitting constraints, and encouraging CHP using any fuel, not just gas.

The three panelists provided "case study" examples of CHP in institutional, community, and industrial environments. Mr. Johnson of UCLA described the CHP system installed at the university. The CHP system provides 43.5 MW of steam and air conditioning and reaches 60% efficiency. The system has reduced Nox and particulates in Los Angeles, a non-attainment area. The project had been a success in terms of financial payoff as well, reducing electricity costs $3 million. Although the local utility (LADWP) originally opposed the project, it now realizes the benefits.

Chris Flavin of Worldwatch Institute spoke on "Decentralizing the Energy System." His presentation focused on development of an energy-efficient and decentralized economy, with primary energy resources being the sun, wind, and other renewable sources of energy. Mr. Flavin made the following major points:

- Focus on small-scale CHP, to provide electricity, and avoid waste heat loss
- Use a variety of new technologies to do this, including reciprocating engines, micro-turbines, sterling engines, and fuel cells.
- Drive CHP markets open with incentives.
- Take advantage of opportunities, both in the developing and the developed world, to

design and install decentralized power facilities, primarily CHP systems.

Al Forte of American Home Products (AHP) spoke of his company's experience with combined heat and power technology. AHP is a producer of prescription drugs, bio-technology produces, vaccines, consumer health products, and agricultural and animal products. The company has sales of $15 billion per year, and employees 60,000 people at 110 manufacturing and office sites around the globe. Total utility costs are $120 million/year. AHP has utilized CHP at its Pearl River plant in New Jersey, and is planning to install CHP systems in its plants in Massachusetts, Puerto Rico, Ireland, and Italy. Mr. Forte's presentation included the following major points:

- To convince upper management of the validity of CHP, energy managers need to show that it will lower utility costs, increase plant efficiency, provide fuel flexibility and diversity, and provides efficient capacity for future growth at the plant
- Internal barriers to cogeneration include high hurdle rates, capital and maintenance intensity, complex engineering and management, and a need to focus on the "core business" of the business, not on energy.
- External barriers to cogeneration include environmental policies, such as special permit requirements, regulations that favor existing old base load plants, and a lack of incentives for energy efficiency; and utility policies that include punitive demand charges, steep exit fees, and other anti-competitive behavior.
- AHP is satisfied with its investment in CHP, which has returned over $4 million to the company and plans to install the technology in four new plants.
- AHP supports incentives for energy efficiency and educational efforts for both regulators and corporate senior managers.

Panel Discussion: Barriers to the Use of CHP and Strategies for Overcoming Them

This panel featured two speakers, Stephen Connors of Massachusetts Institute of Technology (MIT) and John Wimberly, of I.C. Thomasson Associates. The panel was moderated by Tom Casten of Trigen Energy.

Mr. Casten opened the panel with a discussion on the comparative efficiencies of CHP and traditional fuel and heat generation. Compared to the most efficient electric generation technologies (55%) CHP systems achieve efficiencies that range from 62-85%. Barriers to achieving these efficiencies include

-- monopoly protection for central station generation;
– support for anti-competitive practices such as real-time pricing;
– environmental rules which penalize efficiency (e.g., new source performance standard which encourages old technologies);
– tax policies which require 20 year depreciation schedules; and
– federal and state laws and regulations which discourage energy efficiency (e.g., bans on 3rd party ownership of generation, siting laws which delay construction,

etc.).

Mr. Connors' presentation, "Barriers to the Use of CHP, M.I.T. Perspectives", described the regulatory roadblocks which were placed in the way of that institution's installation of a CHP system on its campus. M.I.T. decided to install CHP due to price volatility in the energy sector; a concern with power quality and reliability; the existence of sizable electric and thermal loads; and the presence of antiquated steam plants on campus.

The system M.I.T. chose to install replaced some existing gas and residual oil fired boilers with a topping combustion turbine. At the same time, the university negotiated with Commonwealth Energy subsidiaries (COM/Electric and COM/Gas) for long-term natural gas and standby and supplementary power contracts. The university expected to meet 94% of its electricity, heating, and cooling needs, and 20MW or M.I.T.'s average 23 MW load and achieve utility savings of 15% over twenty years, with a payback time of seven years.

M.I.T. proceeded with its construction schedule, while negotiations with the local utility for back-up power proceeded. When the system was about to come on-line in 1995, the Massachusetts Department of Public Utilities granted COM/Electric 75% of their requested transition charge, increasing M.I.T.'s cost of generation by about $0.01/kWh. After three years of legal wrangling, M.I.T. still has not received any of its anticipated savings from the CHP system. The university recommends:

- a technological "plug and play" environment (get away from the central station infrastructure);
- a regulatory "plug and play" environment for rate provisions and performance standards (move to the customer in space and time); and
- a stable decision-making environment.

Mr. Wimberly's firm, I.C. Thomasson Associates, was the designer of the Opryland Hotel, which utilizes combined heat and power for its thermal and electric loads. His experience with CHP has been positive, although barriers are definitely problematic. His presentation included the following points:

- CHP is best suited for medium to large institutions and industrial process plants with 4-20 MW power loads and 20-250 klb/hr steam usage.
- It is critical to match the thermal and power load profile of the user with the proposed CHP system
- Successful projects must have an internal advocate, or champion

Barriers to CHP include:

- lack of industry-wide acceptance
- uncertain utility rate projections

- greater than 3 year simple payback
- complexity of CHP systems, lack of educated owners/managers/operators
- uneven credibility of CHP companies, and those marketing CHP systems
- owner reticence to deal with new technologies
- utility interconnection requirements and fees that cause CHP installations to be more complication and expensive than necessary
- air quality permitting requirements which can be complicated, costly, and time consuming

The Opryland Hotel CHP project overcame these barriers. The CHP system displaces purchase power only, saving the facility over $1.5 million in electricity each year. The system uses a gas turbine generator (5 MW) with inlet air cooling. The heat recovery steam generator is 97% efficient and the chilled water plant has a 9,000 ton capacity and is used for excess free steam.

Luncheon Speaker: Michael Wiggin, CANMET Energy Technology Center, Natural Resources, Canada

Mr. Wiggin's presentation focused on the environmental implications of using combined heat and power, as well as the need to involve community leaders and residents in the decisions involving distributed generation. He provided some background data on the way in which numerous European countries – including the Netherlands, Denmark, Finland, and the United Kingdom – are successfully using CHP to produce both heat and power. Integrating CHP into a community's energy strategy requires answers to questions regarding the local environment, maintaining financial resources within the community, stabilizing energy prices for residents and businesses, and providing markets for local energy sources.

Mr. Wiggin described a process for obtaining community support for CHP, which then leads to financial support. In Canada, this process has led to over $140 million worth of CHP projects. In conclusion, he reminded conference participants to locate new generation, preferably CHP, so that the waste heat may be sold; to make sure that CHP is the prime energy source for district energy where renewable energy is not available; and to challenge policy makers to remove barriers to widespread use of CHP.

The Role of Technologies/Systems in Fostering CHP

This panel presented current information on new CHP technologies and systems which can be successfully used to generate heat and power, efficiently and cost-effectively. Even existing equipment, such as boilers and chillers, can be used in new, more energy efficient ways. The panel featured three speakers, Bill Parks, the manager of DOE's CHP Challenge Program; Mark Spurr, of the International District Energy Association, and Keither Davidson, of Onsite Sycom, representing the National Association of Energy Service Companies.

Mr. Parks opened the panel with a short review of some of the new technologies and systems in

the marketplace.

Mr. Spurr presented information about the important role of district energy in integrating energy supply and demand in communities throughout the world. New advances in waste heat distribution, water transport, use of waste heat for absorption chillers, and industrial production of waste heat were discussed. Mr. Spurr then showed a videotape of the district energy system in Gothenburg, Sweden. This system was established in the 1950's and includes industry-produced waste heat, which is used to heat homes and businesses; the use of refuse for fuel; energy captured from the community's sewage treatment plant; and other techniques that make the community a complete energy system.

Mr. Davidson's presentation included information about the role of energy service companies (ESCOs) in implementing combined heat and power systems for industrial and commercial facilities. He discussed the advantages of on-site power, including heat recovery utilization; improved power quality and reliability; environmental and efficiency benefits; lower operating costs; and flexibility of power supply.

He discussed a number of CHP technologies including steam turbines, reciprocating engines, industrial gas turbines, micro-turbines, and fuel cells. He made the following points about the use of these technologies for CHP:

- "One size does not fit all" - there is a market need for a full range of sizes, from 50kW to 40 MW
- Environmental profiles of selected equipment is very important
- Reliability and power quality enhancements are increasingly important
- Seamless integration (direct drive, grid interconnect, electric/thermal load flexibility) is critical

Mr. Davidson recommended the following CHP technology needs:

- improved compatibility with more byproduct fuels
- improved fuel source flexibility
- improved integration between thermal/electric; thermal/mechanical; and process integration systems
- better interface with the utility system and improved information systems.

Panel Discussion: State and Local Perspectives on CHP

This panel, moderated by Carol Werner, Executive Director of the Environmental and Energy Study Institute, also included Gordon Bloomquist, of the Washington State University Energy Program and Rich Sedano of the Vermont Department of Public Service.

Mr. Bloomquist's presentation, *Developing a State Cogeneration Program,* outlined the issues

and opportunities associated with installing cogeneration, or CHP systems, at state institutions with existing district heating and cooling systems. In the early 1990's, the state of Washington began an institutional cogeneration program with a goal of developing cogeneration at the state's major institutions. It was designed to promote conservation at all state facilities, using a broad array of financing options, and to enhance development of comprehensive technical services in the areas of engineering, economic analysis, and financing.

Mr. Bloomquist described project financing mechanisms which may be considered in designing a state cogeneration program, including capital budget funding, state-issued revenue bonds, and third party financing. He further discussed the need for the lead state agency to have legislatively explicit duties, authorization, and responsibilities for identifying evaluating, and developing cogeneration opportunities in state facilities. He provided a number of recommendations for other states interested in furthering CHP, including:

- providing incentives to overcome financial project risk
- providing flexible financing options
- locating secure program funding
- securing a good contracting/leasing authority for long-term contracts; and
- making sure that the government agency has the authority to support committed long-term action, including raising funds through bonds or securing 3rd party financing.

He concluded with a discussion of the institutional factors within state government agencies which provide the positive framework for successful implementation of CHP in state facilities.

The second presentation of this panel was delivered by Richard Sedano, Commissioner of the Vermont Department of Public Service. The presentation was titled *Combined Heat & Power: Customer-Focused Design for Efficiency.* He spoke of the rationale for supporting CHP in a low-emissions, low-cost state like Vermont, including the inherent value of energy, environmental, and cost efficiencies, and the customer-focus of this technology. Vermont's concerns about CHP include market barriers (i.e., people do not know it is an option); permitting, particularly land use, lack of utility incentives caused by the fear of lost revenue, and the lack of knowledge about deployment potential.

Mr. Sedano spoke of Vermont's support for CHP, offering the following examples of legislative and institutional activity:

- passage of net metering legislation
- interconnection guidelines
- distributed utility planning as regulatory policy
- energy office grant writing and planning
- interagency cooperation.

Vermont's electric restructuring legislation will hopefully include a renewable portfolio standard,

an R&D fund for small renewable technology, and exemption for CHP from any exit fees imposed by utilities. Existing and planned CHP projects in Vermont include a number of industrial applications, ski areas (e.g., Killington, 60 MW) , a district energy plant (Burlington Electric waste heat project with wood chip fuel source), a farm project using methane, and a number of projects in the discussion stage, involving farmers, dairymen, university and industrial organizations.

Informal Discussion: National CHP Initiatives

The final panel of the Summit featured a presentation by Paul Stolpman, Director of EPA's Office of Atmospheric Programs, and concluding remarks by Peter Carroll of the U.S. Combined Heat & Power Association, and Dan Reicher.

Mr. Stolpman's presentation, *EPA Initiatives in Support of Combined Heat and Power*, focused on both regulatory and non-regulatory efforts to support this technology. On the regulatory side, EPA is supporting emission caps, fuel neutral/output-based approaches for new power installations, and reforms in its new source review and PSD program, so that energy efficiency is rewarded, not penalized. EPA recognizes CHP as a key component of climate policy and is committed to pursuing regulatory actions to level the playing field for CHP. He asked for continuing input from industry to improve EPA's understanding of regulatory barriers.

Peter Carroll then challenged the audience to continue their support for CHP, particularly in the transitional period of deregulation, that although people may be uncomfortable with change, there is merit in CHP as an energy strategy for the country. It can be proven technologically, and it is reliable. He reminded the audience that timing is important to successful implementation of CHP and thus, they must work quickly to see that it becomes a part of each state's energy program.

Dan Reicher concluded the Summit by accepting the challenge to move quickly in the following manner:

- Develop a CHP Vision, to double the amount of energy supplied with CHP by 2010
- Quantify the benefits of CHP
- Share the vision and the benefits with people throughout the country; to see if it makes sense, the "get a reality check" on the technology
- Develop a "Roadmap" for CHP, examining the technology, the policy, and the market issues required to make it a national strategy. A Roadmap will answer questions such as "What do we need to do? What are the policy changes? What are the high priority market things we can do?"
- Develop a Plan to address the Roadmap, to outline action that needs to be taken, analysis that needs to be performed, public outreach required, and niche markets we can get into
- Measure the progress
- Adjust the Vision to reflect the priorities articulated by consumers and suppliers.

The DOE's program, Mr. Reicher said, needs to be inclusive and focused, as well as expeditiously carried out, so as to influence the appropriations process and influence international energy production.

Mr. Reicher concluded with a commitment to communicate back to attendees with the Agency's next steps as it implements the CHP Challenge.